Echotek Update

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Tevatron BPM Meeting

Since Last Week

- Received feedback from Bob, Gustavo, and Jim on last week's presentation.
- Attempted to formulate a proposal for a series of tests using Jim's FCC setup to help determine the system configuration.

Step #1

- The proposed setup for the system which I presented at last week's meeting is based on the assumption that it is necessary to trigger the system on each turn to provide the full set of functionality.
- As a first step, it would be useful to see how much functionality we can obtain in a free running mode.

Step #1 (cont.)

- For one Echotek input channel, setup two Grey chip channels (one for turn-by-turn decimation and a second for “closed orbit” or maximum decimation).
- Setup the Echotek board to trigger and record samples from both Grey chip channels. No modifications to FPGA.
- Key question is how does FPGA separate data from two channels in output memory.

Step #2

- A second interesting question is whether "closed orbit" decimation in the Grey chip can work properly if triggering once per turn.
- Test would be to run with normal "closed orbit" mode setup, and then change the trigger to fire once per turn.
- Determine the effect of over-triggering on the "closed orbit" output.

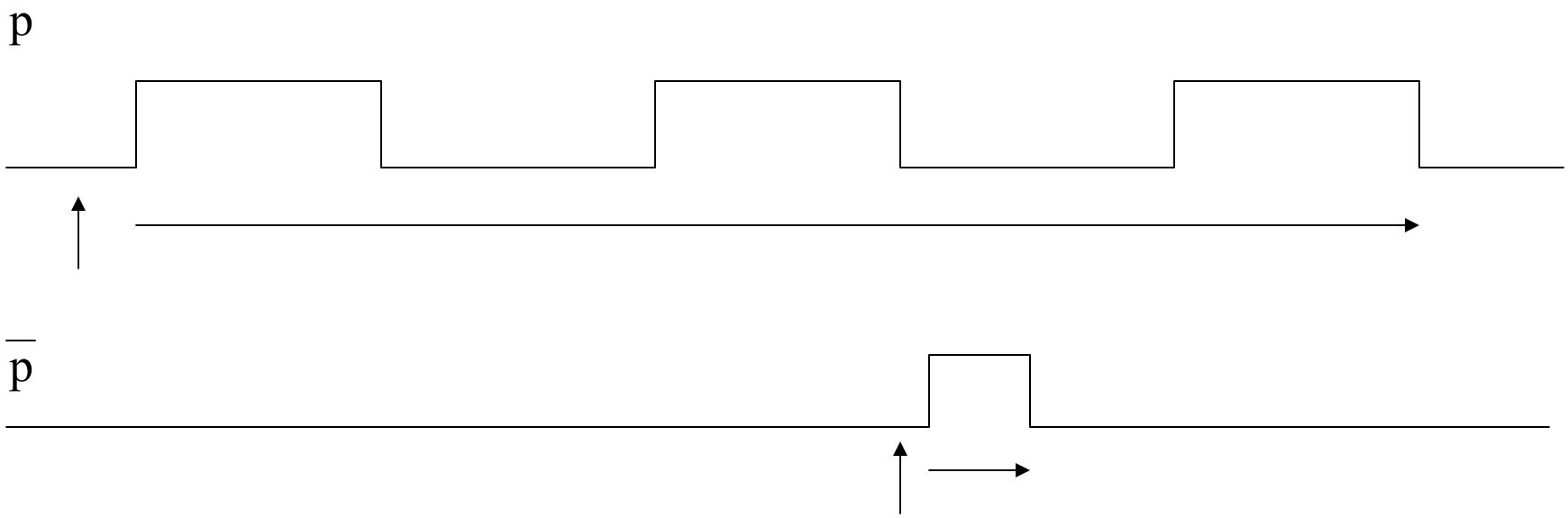
Step #3

- The results of the first two steps might lead us in another direction. If not, several tests would be required to see if my proposed system is viable.
- First, setup system to trigger once per turn.
- Set proton inputs (channels 0,1) to turn-by-turn decimation in Grey Chip. Set antiproton inputs (channels 2,3) for bunch-by-bunch decimation in Grey Chip.

Step #3 (cont.)

- Ask for one point per trigger.
- No modification to FPGA required.
- Key question to answer is effect of the pipeline in Grey Chip. Chip resets with each trigger and the question is whether the first data point is valid. If not, how many data points must be taken before the answer is valid?

Step #3 (cont.)

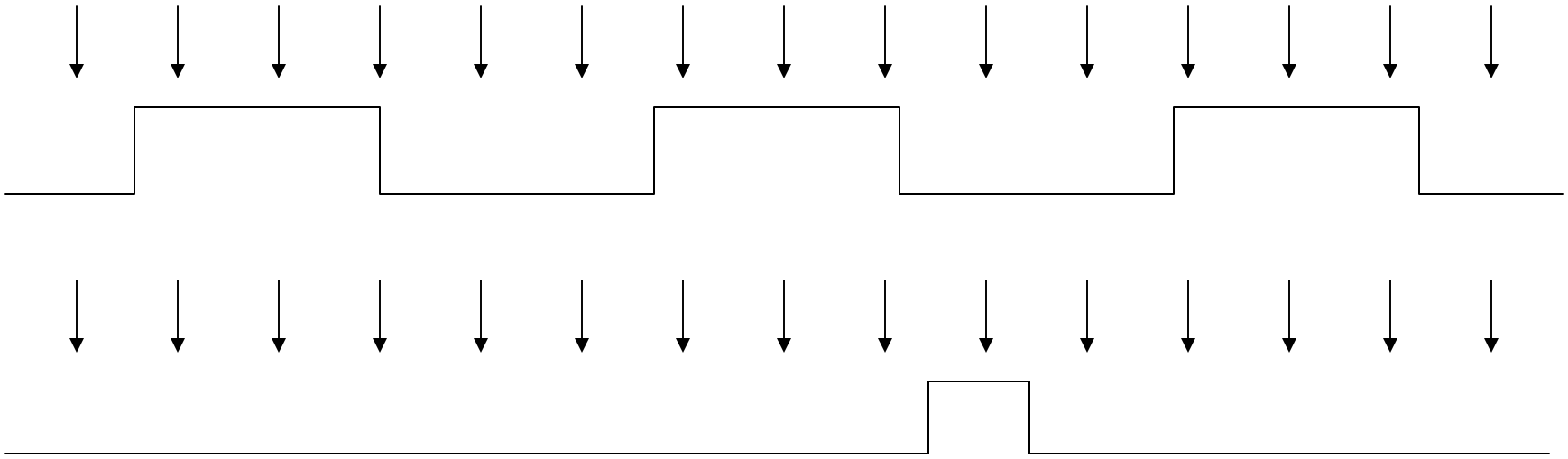


Question : Can Grey Chip produce valid answer for one turn worth of data before next trigger?

Step #4

- If we are successful in step #3, the next step would be to make some simple modifications in FPGA to accept multiple points per turn, reject non-beam points, and combine the remaining points to produce turn-by-turn data.
- This step should represent a fairly simple modification to FPGA.

Step #4 (cont.)



Filter Outputs: colliding beam structure (top) and single test bunch (bottom). FPGA removes noise points between beam bunches.

Step #5

- If these configurations can be made to work, then the final step would be to make more significant changes to the FPGA to make "closed orbit" measurements starting from the turn-by-turn data.
- Three possible scenarios for output:
  - Σ (I) and Σ (Q) using every 5^{th} point.
  - $\Sigma (I^2 + Q^2)$
  - $\Sigma (I^2 + Q^2)^{1/2}$

Step #5 (cont.)

- As a reminder, the idea is to make the "closed-orbit" data available in the FPGA (readable from VME) and continually write the turn-by-turn data into onboard SRAM (formatted as circular buffer) for access as needed.